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ROOMS FOR DEVELOPMENTAL SCIENCE COURSES. SCHOOL FACILITIES FOR SCIENCE INSTRUCTION, 2ND EDITION.

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MANY HIGH SCHOOLS ARE BROADENING THEIR SCIENCE CURRICULUM WITH SPECIALIZED COURSES. THIS REPORT SURVEYS THE NATURE OF THESE COURSES AS BEING--(1) DEVELOPMENTAL, (2) APPLIED, AND (3) SPECIALIZED. A SURVEY OF THE SEPARATE SCIENCE COURSES REVEALS THAT ONLY A FEW CLEARLY FIT INTO THE ABOVE THREE CLASSIFICATIONS. MOST COURSES BY NATURE OVERLAP EITHER TWO OR THREE OF THESE CLASSIFICATIONS. THE REPORT CONTINUES BY DESCRIBING THE GENERAL NATURE OF FACILITIES FOR DEVELOPMENTAL SCIENCE COURSES. FACILITIES FOR A PHYSICAL SCIENCE LAB ARE EXAMINED. THE COURSE CONTENT IS DESCRIBED AND AN ANALYSIS OF THE CLASSROOM ACTIVITIES IS MADE. REQUIREMENTS FOR THE DESIGN OF THIS FACILITY ARE THEN DISCUSSED BASED ON THE ANALYSIS OF THE ACTIVITIES. A FUNDAMENTAL REQUIREMENT FOR MOST SCIENCE ROOMS IS FLEXIBILITY OF SPACE. EQUIPMENT, UTILITIES AND SERVICES FOR A PHYSICAL SCIENCE ROOM ARE QUITE SIMILAR TO THOSE USED FOR PHYSICS AND CHEMISTRY, HOWEVER, THERE IS AN ADDITIONAL NEED OF EQUIPMENT AND SERVICES FOR METEROLOGICAL AND ASTRONOMY ACTIVITIES. SOME PROVISIONS SHOULD BE MADE TO EQUIP THE LAB WITH A WEATHER STATION AND INSTRUMENTATION FOR THE STUDY OF ASTRONOMY. THE USUAL STORAGE PROVISIONS FOR SCIENCE ROOMS ARE ALSO REQUIRED FOR THE PHYSICAL SCIENCE ROOM. THE STRONG EMPHASIS ON EXPERIMENTATION AND INDEPENDENT INVESTIGATION IN THIS COURSE, REQUIRES PROVISIONS OF STORAGE SPACE FOR SUPPLIES NEEDED IN CURRENT INVESTIGATION AND FOR BOOKS AND OTHER INFORMATIONAL MATERIALS. A DISCUSSION ON REQUIREMENTS FOR CONSERVATION AND EARTH SCIENCE FACILITIES APPEARS IN THE FINAL SECTION. (RH)

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SCHOOL FACILITIES FOR SCIENCE INSTRUCTION

Second Edition

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chapter 9

FACILITIES FOR DEVELOPMENTAL, APPLIED, AND SPECIALIZED COURSES IN HIGH SCHOOL SCIENCE

INTRODUCTION

Many schools are broadening the curriculum in science. Numerous courses are provided to extend the range and the quality of school science experiences.

Nature of Courses

Because the courses of this general group are so different in purpose and nature, their classification is less definitive than that of the four common high school sciences. A study of their objectives indicates that, in general, they represent these major aspects of curricular effort.

(1) *Developmental.* Such courses generally attempt to interrelate various fields of science, the interrelationships often resulting from the choice of content from the different fields to help solve some problem that the student faces. These courses tend to evolve and develop in relation to the needs of the students and the school, and the insight of the teacher.

(2) *Applied.* These courses involve the teaching of science as it is directly applied to some phase of human activity such as machines which transform energy and materials, the instruments we use, and the ways we can conserve our resources and guard our health.

(3) *Specialized.* These courses make possible more intensive study of a field of science, often the more theoretical aspects being involved, although such courses are on occasion more extensive as well as intensive.

A survey of the separate courses reveals that only a few are clearly categorized in the three groups. Among the more commonly found courses are:

Advanced Biology	Health
Aeronautics or Aviation	Photography
Applied Chemistry	Laboratory Techniques
Applied Physics	Life Science
Applied Science	Physical Science
Botany	Physiology
Conservation	Radio
Consumer Science	Science Seminar
Earth Science	Senior Science
Electricity	Zoology

Several of the courses listed can be placed in two or even three of the categories given, depending upon the plan followed in a given school. It is probable, however, that for a particular school there is a major emphasis of each course that would cause it to be placed in one of the three groups.

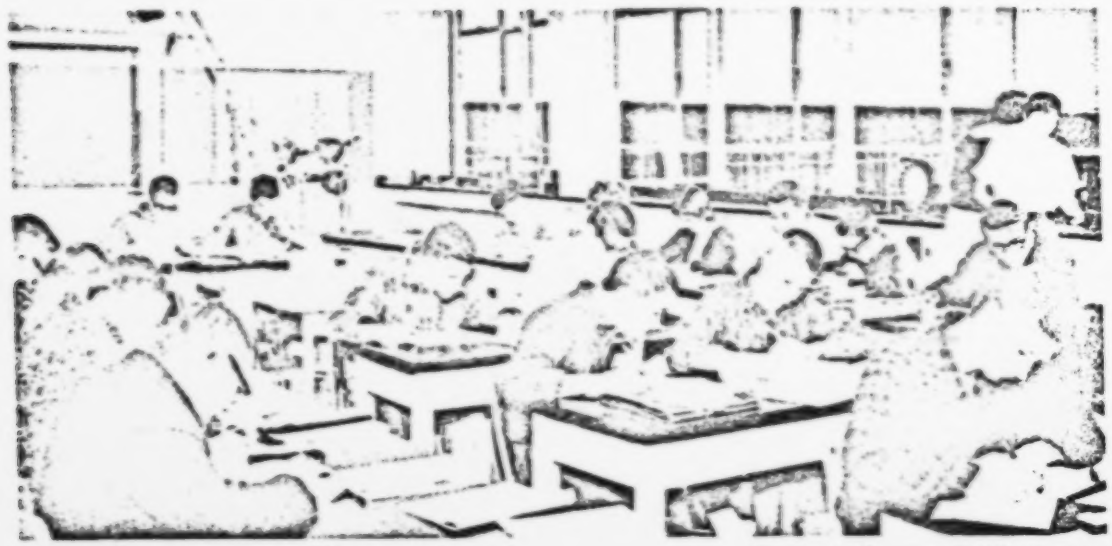
General Nature of Facilities

The general qualities of facilities as described in Chapter II, GENERAL ASPECTS OF SCHOOL SCIENCE FACILITIES, are desirable in any room used for science teaching and thus should be sought in rooms used for developmental, applied, or specialized science courses. Likewise, attention should be given to Chapters IV, V, VI, VII, and VIII, particularly as a given course is related to one of the four commonly offered courses. For example, the planning of a room for botany teaching can be related to Chapter VI, FACILITIES FOR HIGH SCHOOL BIOLOGICAL SCIENCE, and the planning of a room for electricity can be related to Chapter VIII, FACILITIES FOR HIGH SCHOOL PHYSICS. To a considerable extent the differences in facilities needed for the developmental, applied, and specialized courses are in the kinds and amounts of apparatus and supplies needed, although there are some essential differences in room plan and utilities.

ROOMS FOR DEVELOPMENTAL SCIENCE COURSES

Provisions for developmental or emerging courses are necessarily of great flexibility. There is an emphasis upon an extended array of resources to provide for developing interests and for the exploration of relationships. Courses in physical science, earth science, and conservation are generally such that they can be classified as developmental.

The flexibility in room arrangement achieved in the rooms described in Chapter IV, FACILITIES FOR THE HIGH SCHOOL MULTIPURPOSE SCIENCE ROOM, and in Chapter V, FACILITIES FOR HIGH SCHOOL GENERAL SCIENCE is desirable in rooms used for developmental courses. Other room arrangements are given in the following section.



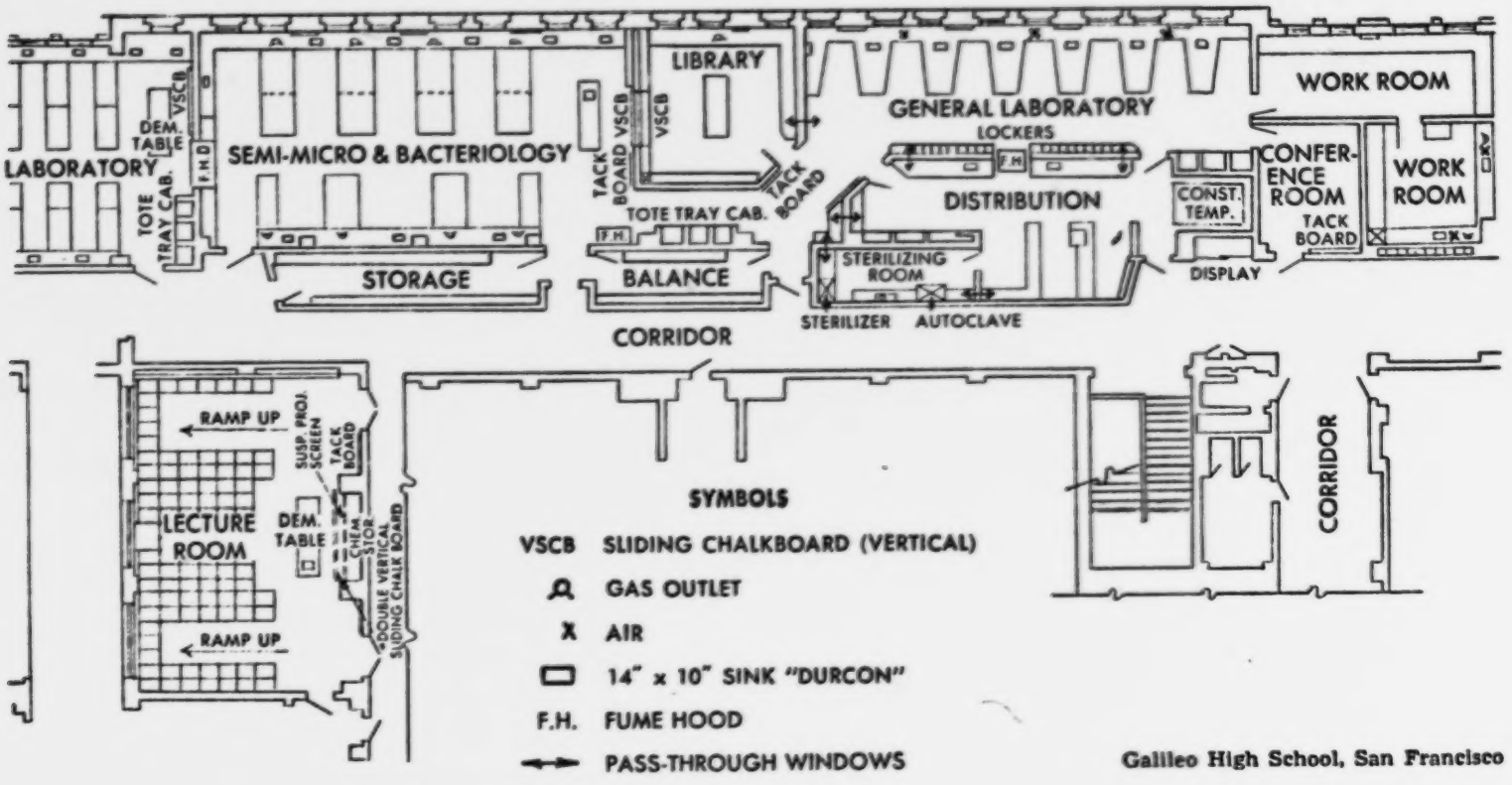
Portland, Oregon, Public Schools

Figure IX—1. A multipurpose science room is used for a course in physics as developed by the Physical Science Study Committee.

Facilities for Physical Science

An outstanding example of a developmental course is physical science. In many schools, physical science is an attempt to satisfy the science needs of senior high school students who are practically certain not to attend college. At the same time these schools and others have been seeking to develop a course for those students who will go to college but who do not have a direct interest in science. Such a course would round out their secondary school science experience. This course would include the basic concepts and principles of the physical sciences, drawing upon illustrative materials as they are appropriate to its principal themes from physics, astronomy, chemistry, and geology. The aim of this type of course is to supply a broad view of the nature and organization of the physical world and a mature approach to scientific concepts.

The steady growth of this type of senior high school physical science course requires consideration of the facilities essential to the achievement of its purpose.



Galileo High School, San Francisco

Figure IX—2. The wealth of resources in these science rooms makes possible a wide range of both general and specialized investigations in science.

An Analysis of Activities

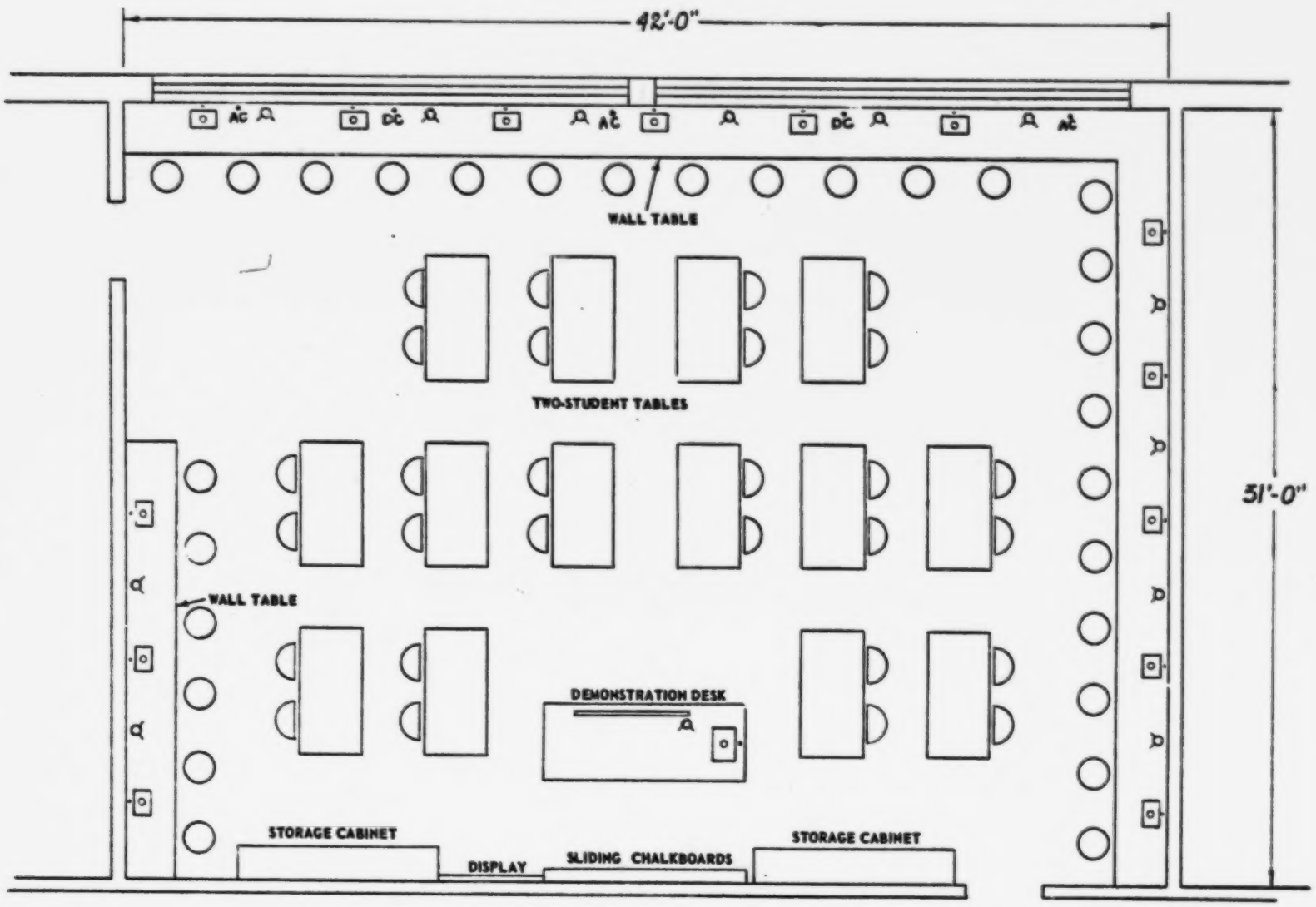
Since one of the aims of the physical science course is to develop a mature approach to scientific concepts, an important element of the course is the opportunity for students to participate in direct observations, measurements, and individual experimentation. In order to achieve this aim, students should be given the chance to hold discussions, work together on projects, and to acquire skills in the manipulation of equipment, the use of tools, and the construction of simple apparatus.

Requirements Based on Activities

The provision of these opportunities requires facilities to serve each aspect of the program. Experimentation and observation require laboratory equipment, space, and supplies. Projects and work with tools require the provision of workshop facilities. Discussions and study require that, in addition to classroom facilities, library books and other sources of information be readily available. In most respects the room facilities necessary for this type of course are not different from those previously discussed for general science and multipurpose science rooms except for the absence of the living materials required for the study of biology.

A fundamental quality of all science rooms is the flexibility of room use. One factor that tends to limit that flexibility is the necessity for utility lines—running water, gas, electricity, and compressed air. The general arrangement by which this problem is reduced is the peripheral room plan as previously described (Chapter IV).

The need for flexibility in rooms for both physical and biological science is accomplished in part as illustrated in Figure IX-3. The movable tables provide for class discussion purposes in a variety of arrangements. They make possible a wide range of other learning activities, including many laboratory operations that do not depend upon utilities. An added advantage is the dispersal of students, giving each more work space.



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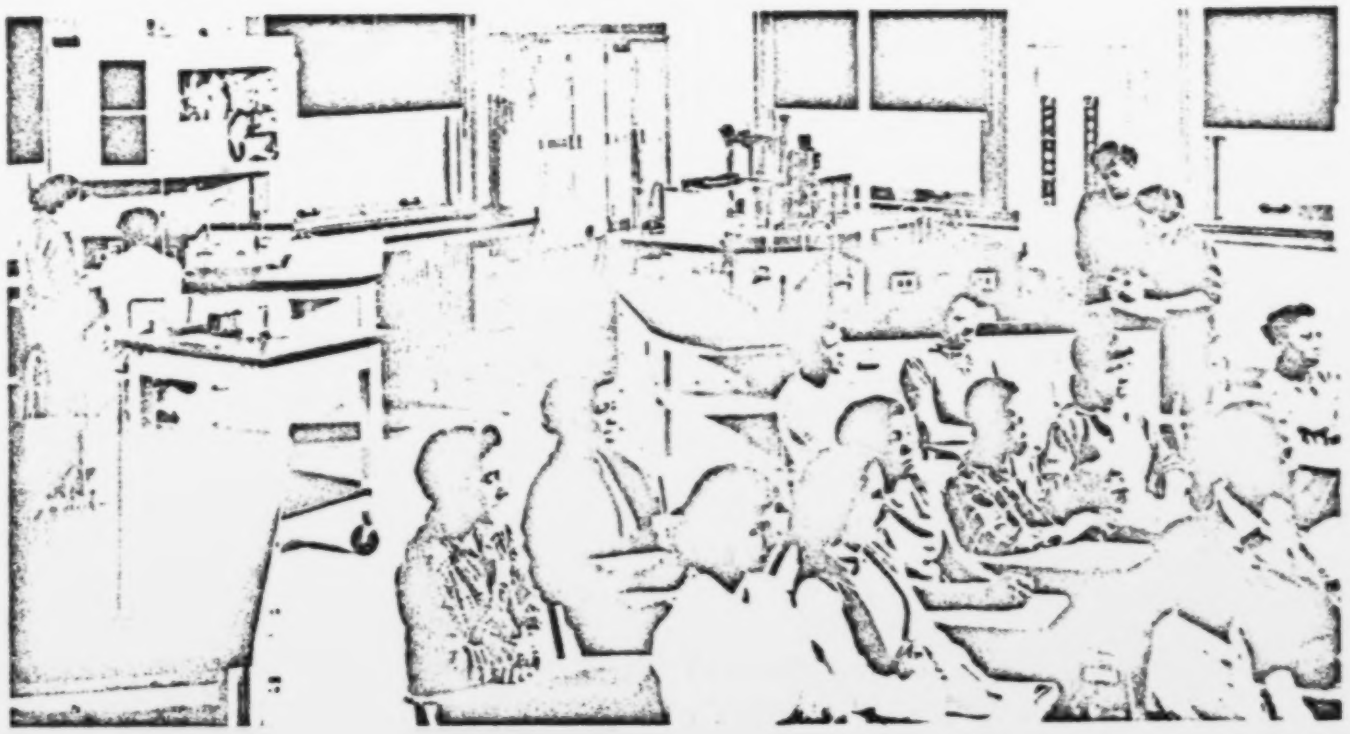
American School Publishing Corporation

Figure IX—3. A relatively long room is used for physical science. Utilities are available only on the wall tables and demonstration desk.

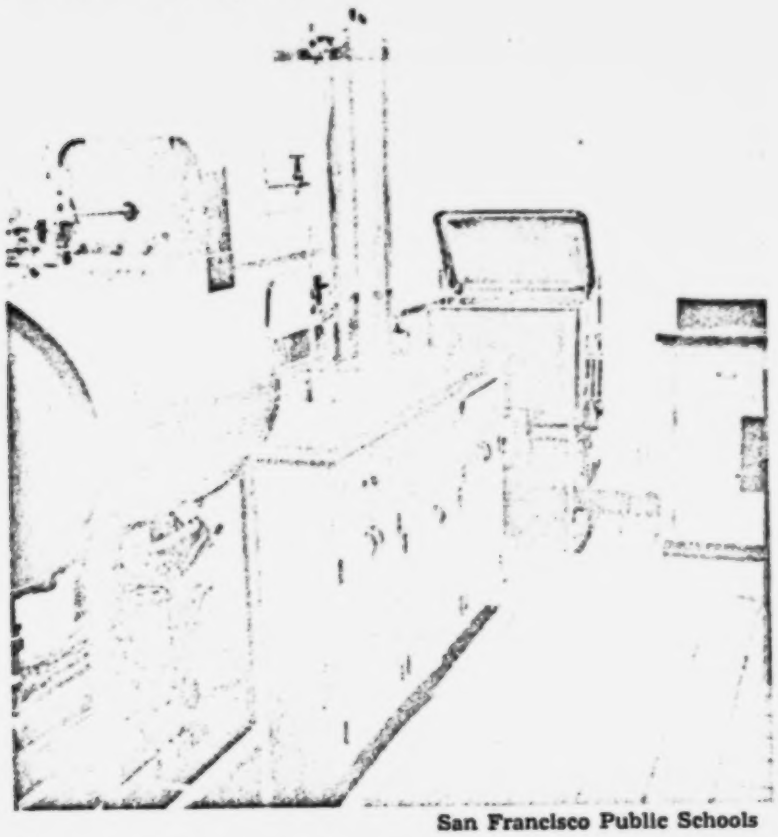
(From Manley, C. B., "Tulsa Builds a High School for Changing Secondary Education." American School and University, Twelfth Edition, p. 28, 1939-1940.)



Pittsburgh Public Schools

Figure IX—4. This physical science room is the result of remodeling an older room. A construction area is provided in the rear. The island desks are assembled from stock base units (see Fig. II—3). The room includes also areas for demonstration, reading (see Fig. I—7), and metal working. A storage room is adjacent.

Physical science rooms must have abundant storage space. Such space may be augmented by a combined storage-preparation room or by a student project room with its own storage facilities.



San Francisco Public Schools

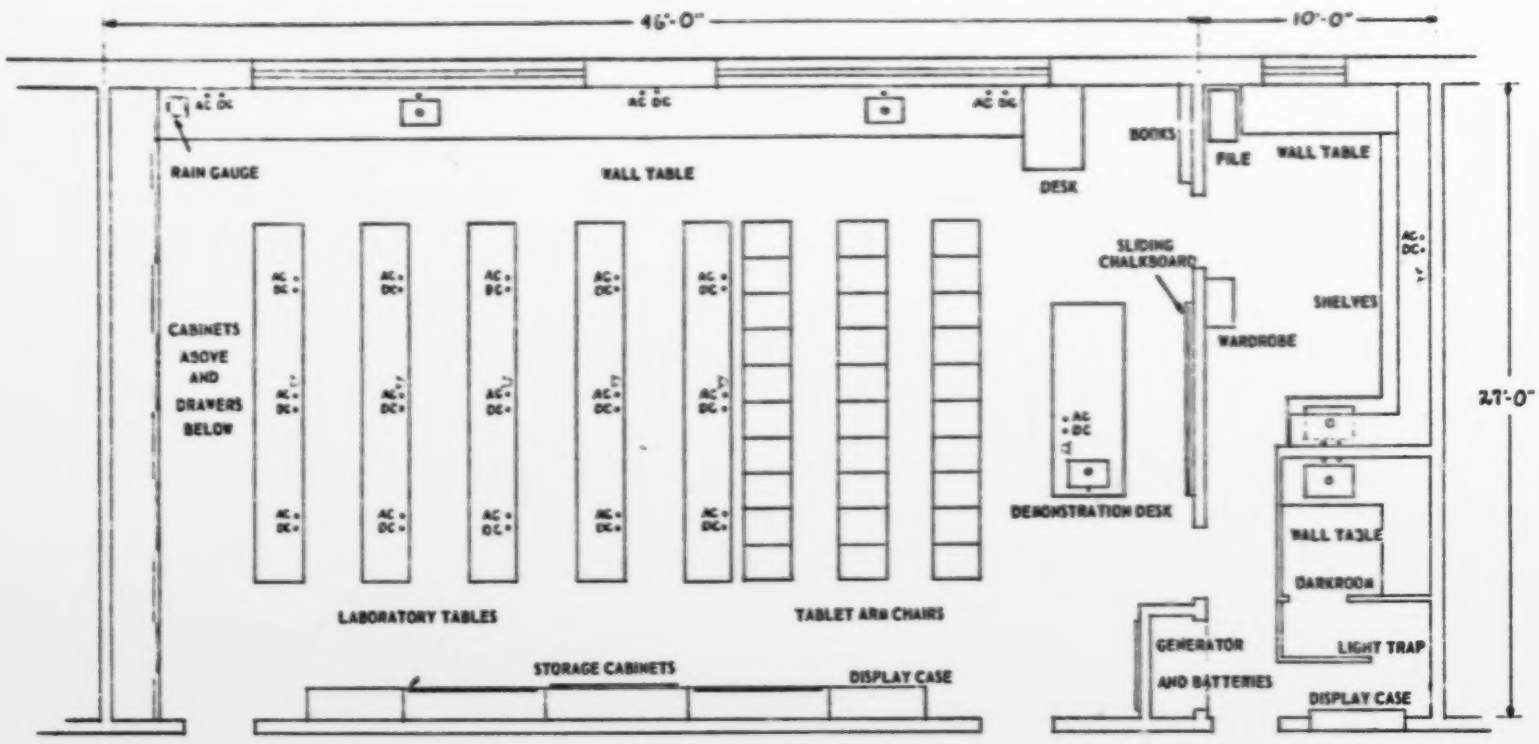
Figure IX—5. This sterilizing room is equipped with an ion-exchange column which provides water for the utensil sterilizer and the autoclave.

A significant factor in the design of a room with peripheral utilities, is the potential for reduced costs. The utility lines are relatively short, thus leading to a lower investment in labor and plumbing; and the tables in the central part of the room are less expensive than those having utility lines.

Another example of a room type suitable for physical science is shown in Figure IX-6. This arrangement provides considerable storage space within the room as well as a separate storage room, a preparation room, and a darkroom adjacent to the laboratory. Access from the corridor enables students to use the auxiliary rooms without disturbing the activities of the laboratory. A double chalkboard with sliding panels is placed at the front. A rolled projection screen is mounted above these chalkboards.

Equipment, Utilities and Services

The equipment, utilities, and services for the physical science room are quite similar to those previously described in the chapters concerned with facilities for physics, chemistry, and multipurpose science rooms with the exception of those facilities which are peculiarly necessary for biology experiences. Since meteorology and astronomy are important areas of physical science, there should be provided a weather station and instruments for the study of astronomy. For both purposes a rooftop which is properly protected and easily accessible is desirable (Figure IX-8) although some schools have found that a weather station in an enclosed area of the school ground is quite



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Los Angeles Public Schools

Figure IX—6. This classroom-laboratory is planned for physics and physical science. The storage cabinets along the rear of the room and the inner walls are fitted with sliding panels of chalkboard and tackboard.

satisfactory (Figure IX-9). If a roof area is used it should be flat, protected by guard rails or walls, and well illuminated. The space should be equipped with a permanent mount for a telescope and an instrument shelter for weather instruments.

Facilities for Storage and Preparation

The usual storage provisions for science rooms are needed also in the physical science room. The strong emphasis upon experimentation and independent investigation in this course requires provision of storage space for supplies needed in current experimentation and for books and other informational materials.

This emphasis also requires the provision of some space and facilities for relatively large numbers of students to pursue independent projects and investigations simultaneously.

This arrangement can be effected by devoting large areas of the room or science suite to workshop, darkroom, and library. A part of the usual storage space given to equipment may be reserved as student lockers for unfinished work. This can be easily accomplished in view of the fact that, where several sciences are taught in one room, the storage space devoted to general supplies may be reduced considerably from that required where physics, biology, or chemistry are taught separately.

The University School, The Ohio State University

Figure IX—7. The students in this physical science laboratory find the operation of an automobile engine a source of application of principles of science.

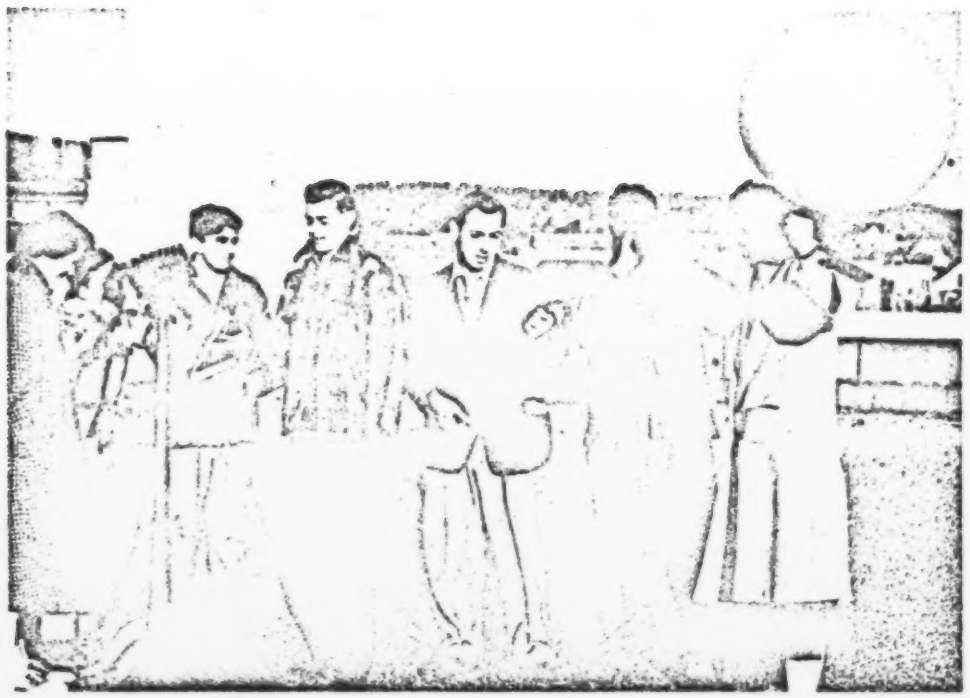

Figure IX—8. Students prepare to follow a balloon by means of a theodolite on a roof-top weather station. The two rooms housing the weather bureau in this high school are located also on the roof. A weather vane and anemometer are mounted on a support; the indicators connected to them are within the bureau headquarters, as is the other accessory equipment.

Malden, Massachusetts, High School

Facilities for Conservation and Earth Science

Provisions for the teaching of conservation are somewhat similar to those for physical science; in addition there should be rather extensive facilities for the use and display of such teaching materials as living and preserved plants, soil and rock samples, minerals, various kinds of models, charts and graphs, and fabricated articles. In view of the rather extensive use made of projects and other group and individual activities, there should be generous provision for reading, construction, and small group meetings; a separate project room with individual work areas and resources meets this need.

Earth science requires resources similar to those for conservation, the provisions for living materials being relatively less necessary. An erosion table built in the form of a large shallow tank with a drain and a source of running water above to provide "rain" is a valuable asset.

The storage needs of conservation and earth science merit special attention. Each of these subjects draws from several of the content fields of science. The storage of apparatus and supplies from these areas must be of diverse kinds; living plants and animals, physics apparatus, chemicals, soil samples, fertilizers, rocks, charts, and supplies needed for field work must be provided for. In a small school these and other resources may be drawn from the storage for the conventional courses. In the large school or in the school giving extensive attention to conservation it is desirable to provide separate storage, even though the needs are diverse.

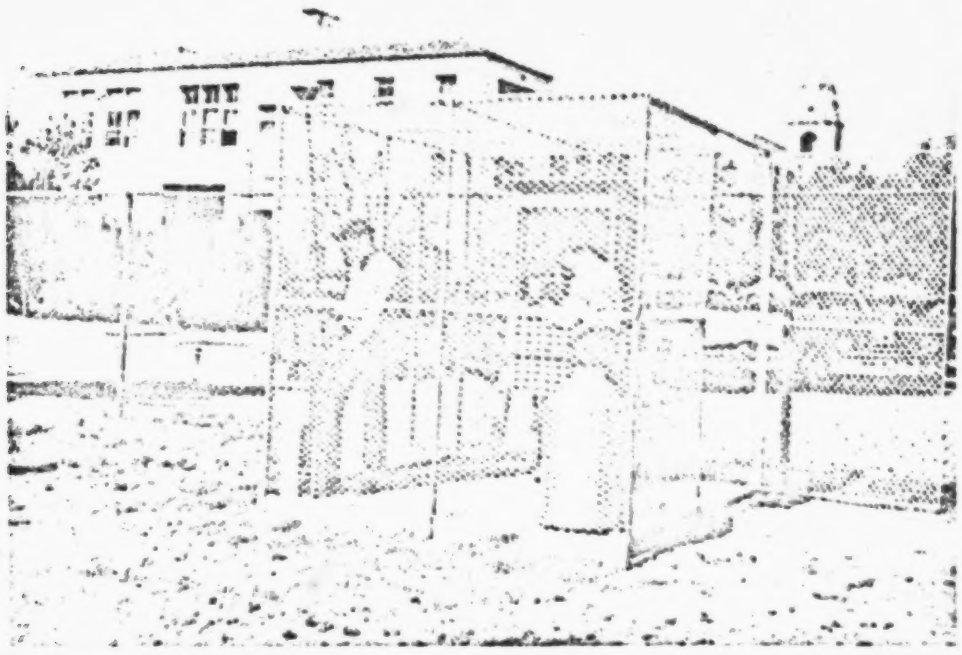

Figure IX—9. This out-of-door weather shelter is a part of the facilities for the study of meteorology in this school.

Monrovia-Duarte High School, Monrovia, California

Earth science as a separate course is becoming a more common offering. Such resources as a weather center, planetarium, and telescope should be provided.

Field work and projects require extensive storage of materials for individual students and for small groups. Often such materials must be provided for immediately upon return from a field trip or for storage from day to day as projects are being developed.

U. S. Forest Service

Figure IX—10. A school forest in Snoqualmie National Forest, Washington. Here students have had experience in reforestation and have erected a sign to explain the significance of the site. (Tacoma Public Schools.)